PETRO-CANADA LUBRICANTS

AN HF SINCLAIR BRAND

TECH DATA

CALFLO™ AF

HEAT TRANSFER FLUID

INTRODUCTION

Petro-Canada Lubricants CALFLO AF is a highly efficient heat transfer fluid designed to help lower operating costs in systems where fluid resistance to oxidative breakdown is critical. Formulated with HT-pure, high quality base oils and specially selected additives, CALFLO AF provides high thermal efficiency in systems operating up to 316°C (600°F). A breakthrough chemistry, CALFLO AF can extend fluid life longer than major competitive fluids, lowering operating costs by reducing the frequency of fluid change-outs.

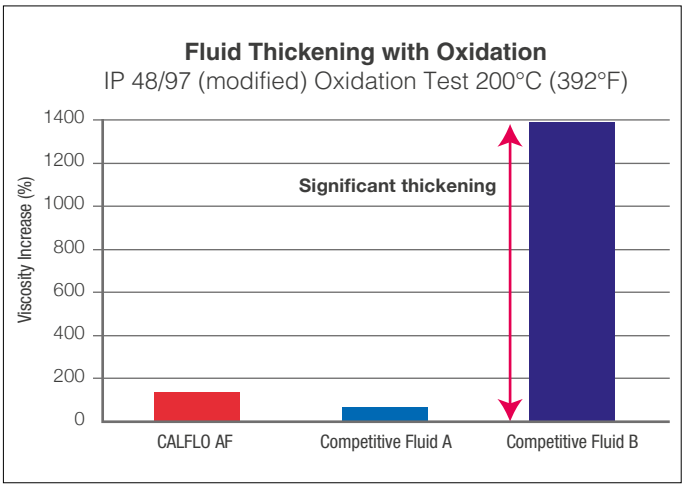
FEATURES AND BENEFITS

Better oxidative resistance than competitors can extend fluid life and lower operating costs

- Higher resistance to oxidative breakdown versus competitive fluids provides an immediate and marked improvement in oil performance

  As a fluid oxidizes, it becomes more viscous. This increase in viscosity can:

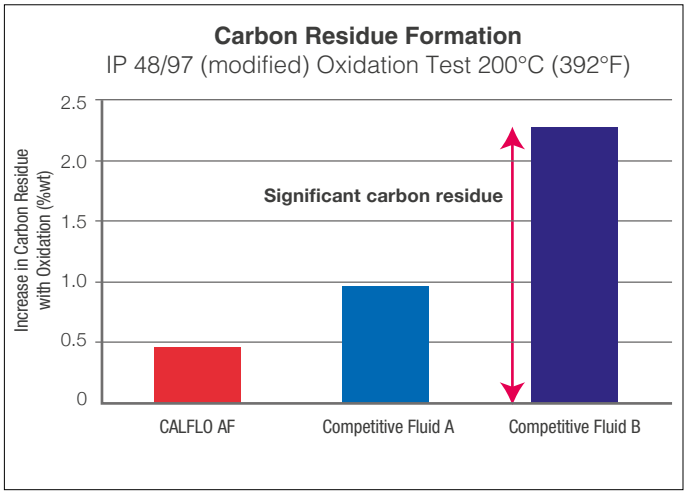
  - significantly reduce a fluid's thermal efficiency
  - make the fluid more difficult to circulate through the heat transfer system
  - result in overheating of the fluid
  - necessitate a costly, premature fluid change-out



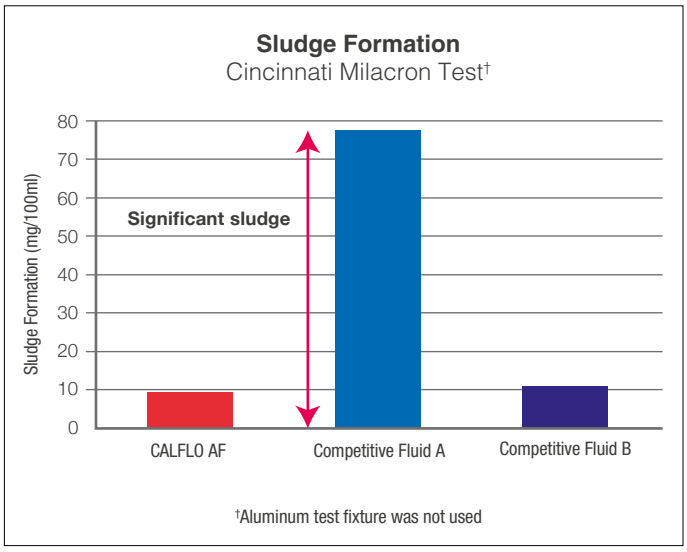
CALFLO AF demonstrates significantly better resistance to viscosity increase versus competitive fluid in a severe oxidation test conducted at an independent industry laboratory.

Less prone to carbon residue and sludge formation versus competitive fluids

- Stronger resistance to oxidative breakdown minimizes the formation of carbonaceous deposits and sludge within heat transfer systems. These deposits can dramatically reduce heat transfer efficiency and increase operating costs.



CALFLO AF demonstrates significantly better resistance to carbon residue formation in severe oxidation testing conducted at an independent industry laboratory.



Even at mild 135°C (275°F) temperature conditions, CALFLO AF provides stronger resistance to sludge formation than other competitive fluids.

Low vapour pressure can save on top-up costs while improving workplace safety

- Excellent low vapour pressure can reduce or eliminate fluid leakage from control valves and pipe flanges.
- Reduction or elimination of leaks provides a cleaner and safer operating environment, and results in operational savings by reducing the need for cleaning, maintenance and fluid top-up.

Natural lubricity extends operational savings

- Strong natural lubricating properties can help reduce maintenance costs by extending the service life of circulating pumps and other rotating parts.

No compromise to environmental and workplace health and safety

- Unlike some alternative fluid chemistries, CALFLO AF is virtually odourless and is not considered a toxic[1] substance according to OSHA (United States), WHMIS (Canada) and EUCLP (Europe) criteria.
- CALFLO AF produces no objectionable odors and is not a respiratory or skin irritant allowing workplace conditions remain pleasant and safe for continuous operations.
- CALFLO AF does not require special handling. Shipments and storage of CALFO AF do not normally require special safety permits. Empty drums used to transport CALFLO AF are readily accepted by drum re-conditioners. In addition, used CALFLO AF may be responsibly disposed in the following ways[2]:
  - through re-sale to used oil recycling companies
  - in some jurisdictions, combined with BTU recovery systems

APPLICATIONS

CALFLO AF is recommended for use in non pressurized, liquid phase, closed heat transfer systems operating at bulk temperatures up to 316°C (600°F). CALFLO AF provides outstanding resistance to oxidative breakdown which can result in longer fluid life and lower operating costs in systems where exposure to air cannot be avoided, and oxidation is the most likely form of fluid degradation. Typical applications include temperature control units used in plastic extrusion, plastic extrusion, injection moulding, metal die-casting and rubber manufacturing operations. It can also be used in shingle manufacturing and lumber drying kilns.

[1] Non-toxic defined as non-controlled under WHIMIS, non-hazardous under OSHA and non- dangerous under EUCLP.
[2] Any transport and disposal practice must be in compliance with federal, state, and provinical and/or local laws and regulations.

OPERATIONAL CONSIDERATIONS

The high thermal stability of CALFLO AF provides long service life under normal operating conditions up to its maximum recommended temperature. However, actual fluid life is dependent upon system design and operating practice.

Special precautions should be taken to avoid operating conditions that can shorten fluid life. These include:

- thermal shocking resulting from accelerated system temperature increases
- thermal shocking from hot spots on a system's heating coils
- continuously running above the maximum recommended operating temperature

Although CALFLO AF is highly resistant to oxidative breakdown, excessive air and water contamination can reduce thermal efficiency and shorten fluid life. Where practical, Petro-Canada Lubricants recommends inert gas blanketing of a system's expansion tank to guard against exposure to air and water and the need to change-out the fluid prematurely.

While CALFLO AF has been formulated to resist breakdown when exposed to air and water, contamination with process chemicals or deteriorated residual fluids can shorten fluid life. To maximize system efficiency and fluid life, Petro-Canada Lubricants highly recommends system cleaning and flushing to remove all contaminants, sludge and varnish prior to recharging a system with CALFLO AF.

THERMAL DATA

PROPERTY	TEMPERATURE			
	15°C (59°F)	38°C (100°F)	260°C (500°F)	316°C (600°F)
Density, kg/L (lb/ft^3)	0.867 (54.1)	0.852 (53.2)	0.715 (44.7)	0.681 (42.5)
Thermal Conductivity, W/m K (BTU/hr.°F.ft)	0.142 (0.082)	0.141 (0.082)	0.130 (0.075)	0.127 (0.073)
Heat Capacity, kJ/kg K (BTU/lb. °F)	1.89 (0.45)	1.96 (0.47)	2.69 (0.64)	2.88 (0.69)
Vapour Pressure, kPa (psia)	0.00 (0.00)	0.00 (0.00)	3.78 (0.55)	15.32 (2.20)

For detailed heat transfer calculations, please refer to a Petro-Canada Lubricants Technical Services Advisor.

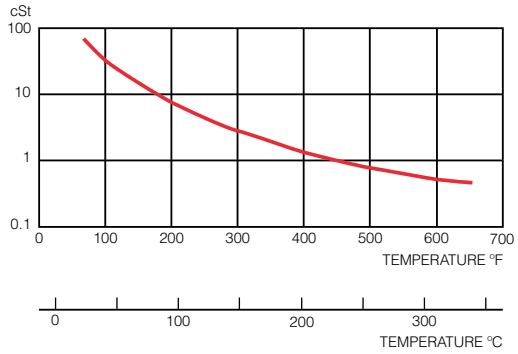
TYPICAL PERFORMANCE DATA

PROPERTY	ASTM Test Method	CALFLO AF
Colour	ASTM D1500	<0.5
Pour Point[1], °C (°F)	ASTM D5950	-39 (-38)
Flash Point, COC, ° C (°F)	ASTM D92	217 (423)
Fire Point, °C (°F)	ASTM D92	240 (464)
Autoignition Temperature, °C (°F)	ASTM E659	343 (649)
Viscosity, cSt at 40°C (104°F) cSt at 100°C (212°F) cSt at 316°C (600°F)	ASTM D445	32.1 5.4 0.7
Average Molecular Weight		371
Neutralization Value, TAN, mg KOH/g	ASTM D664	< 0.1
Sulfur by XRF, wt%	ASTM D4294	< 0.0001
Conradson Carbon Residue, wt %	ASTM D189	0.01
Coefficient of Thermal Expansion, %/°C (%/°F)		0.0907 (0.0504)
Distillation Range, °C (°F) 10% 50% 90%	ASTM D2887	 365 (689) 417 (783) 475 (887)

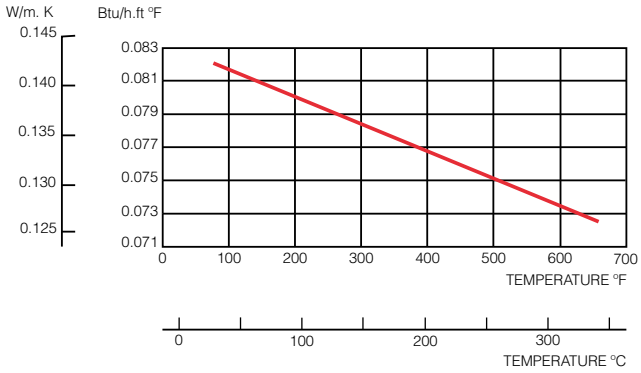
The values quoted above are typical of normal production. They do not constitute a specification.

[1]CALFLO AF provides a new-fluid pour point of -39°C (-38°F). The used fluid pour point may increase over time with prolonged usage at high temperatures.

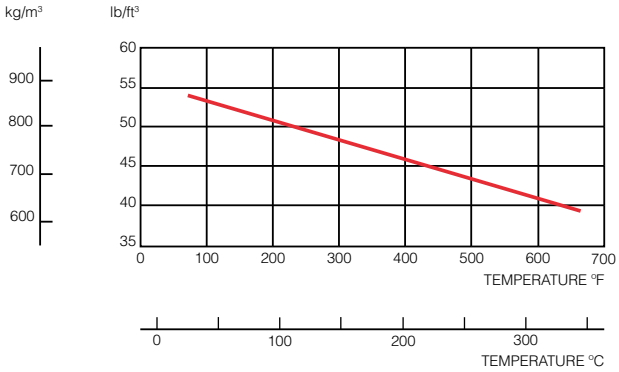
CALFLO AF VISCOSITY



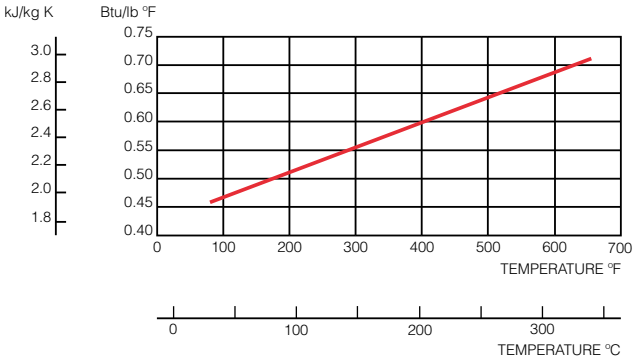
CALFLO AF THERMAL CONDUCTIVITY



CALFLO AF DENSITY



CALFLO AF HEAT CAPACITY



Learn more about us: **petrocanadalubricants.com**
Contact us: **lubecsr@hfsinclair.com**

Committed to the disciplined operation of our business.

CERTIFIED
ISO 9001: 2015
ISO 14001: 2015
IATF 16949: 2016

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